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CASE REPORT

Hepatic portal vein gas as a complication of cryotherapy

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Abstract
Background. Hepatic portal vein gas (HPVG) is a radiological finding normally associated with life-threatening conditions such as mesenteric ischaemia and necrotising enterocolitis in infants. Its presence has previously been associated with a high mortality rate. As a result of more sensitive imaging modalities the spectrum of conditions for which portal vein gas is detected has broadened. We present a patient who developed HPVG as a complication of cryotherapy. The association between portal vein gas and cryotherapy has not previously been described in well over one thousand patients with hepatic cryotherapy reported in the literature.

Key Words: *Hepatic portal vein gas, cryotherapy, cryosurgery*

Case report

A 50-year-old man presented to our unit with a 3-day history of rigors 2 weeks after cryoablation for recurrent colorectal hepatic metastases. Two years previously, in 2001, he had undergone a right hemicolectomy for colorectal carcinoma. In 2002, metastatic liver disease was treated with a combination of hepatic resection and cryotherapy for lesions of 1.5, 1.5 and 3 cm in diameter. In addition, a hepatic artery catheter was inserted. Postoperative intra-arterial 5-fluoro-2-deoxuridine chemotherapy was complicated by sclerosing cholangitis, limiting the treatment course to 2 months and necessitating the change to systemic chemotherapy. In 2003, computer tomography (CT) imaging demonstrated a recurrence at one of the previous cryotherapy sites. Further cryotherapy was undertaken at open operation together with removal of the hepatic artery catheter pump as the catheter had blocked. During this operation a colonic injury was created while dividing adhesions and was oversewn. The postoperative course was complicated by fevers that settled when a right subphrenic collection was drained.

Three weeks after the operation, the patient presented to hospital with a short history of rigors and no other associated symptoms. The physical examination was unremarkable. The liver biochemistry was markedly deranged with a mixed picture of hepatocellular dysfunction and obstruction. A provisional diagnosis of biliary sepsis was made, given the history and a CT scan that demonstrated extensive portal vein gas (Figure 1). Treatment with broad-spectrum intravenous antibiotics was commenced. Ten hours after the CT scan, the patient developed septic shock for which he required aggressive fluid resuscitation and inotropic support in the intensive care unit. The clinical picture improved sharply over the next 24 hours and serial CT imaging revealed complete resolution of the gas within 48 hours.

A number of organisms were isolated from blood cultures taken during the septic episode. These included Enterococcus faecalium, methicillin-resistant Staphylococcus aureus (MRSA), Saccharomyces cerevisiae and Streptococcus spp.

Despite the early signs of recovery, the patient subsequently developed portal vein thrombosis and MRSA intra-hepatic sepsis. Despite aggressive antibiotic therapy and surgical debridement of necrotic liver, he continued to deteriorate and died from hepatic failure 2 months after the initial detection of HPVG.

Discussion

Gas in the portal vein was first reported by Wolfe and Evans in 1955 in infants. Subsequently the condition was described in adults in 1960 [1,2]. In a literature review of all reported cases before 1978 ($n=64$), Liebman and colleagues demonstrated necrotic bowel in 72% and a mortality rate of 75% [3]. Since then, portal vein gas has been associated with a number of

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Figure 1. Computer tomography (CT) scan demonstrating widespread portal vein gas.

other diagnoses including cholangitis, cholecystitis, Crohn's disease, candida enterocolitis in human immunodeficiency virus disease, ischaemic bowel disease and blunt trauma. Iatrogenic causes include sigmoidoscopy, colonoscopy, endoscopic retrograde cholangiopancreatography, barium enema, renal transplants and liver transplants. Despite the increased diagnoses linked with portal vein gas, it still remains most commonly associated with necrotic bowel [4]. The relative increase in iatrogenic causes and the broadening of the clinical settings associated with this condition require the development of more sensitive imaging modalities. Both CT and colour Doppler ultrasound have superior sensitivity for detecting portal vein gas over plain films [5]. Although portal vein gas used to be an absolute indication for laparotomy, most iatrogenic cases have successfully been managed non-operatively [4].

Two pathogenic mechanisms for portal vein gas have been described. The first suggests that increased intraluminal pressure allows gas to enter the mesenteric veins directly through a damaged mucosal wall, while the second proposes that gas-forming micro-organisms gain entry through a damaged endothelium into the portal venous system. Either mechanism would find a favourable environment created with the triad of factors which are considered to predispose to portal vein gas: bowel distension, intestinal wall alteration and sepsis (defined as positive blood culture, abscess or necrotic bowel) [6]. With the exception of sepsis, these factors did not appear to play a major role in the present case. Sepsis was confirmed by positive blood cultures, but there was no suggestion of bowel ischaemia. The presumed mechanism of gas formation in this case is direct micro-organism invasion of the portal system from a cryotherapy abscess that had formed at a cryotherapy site that directly abutted the portal sheath and had become infected from abdominal contamination associated with the colonic perforation.

To our knowledge, portal vein gas has not previously been associated with cryoablation. The association between portal vein gas and cryotherapy has not been described previously in well over one thousand patients undergoing hepatic cryotherapy reported in the literature [7]. We are aware of the risk of cryo-site abscess formation with synchronous cryotherapy and bowel resection. We have previously reported nine patients undergoing synchronous cryotherapy and bowel resection of whom two developed a cryo-site abscess (22%), which is a significantly greater incidence than the accepted figure of 2% achieved in non-synchronous operations [8]. Similarly, synchronous bowel resection and radiofrequency ablation of metastases is also associated with an increased rate of abscess formation and hepatic sepsis [9]. Commonsense dictates that operations that may favour the formation of cryo-site abscesses close to the portal sheath may also favour the development of portal vein gas. While in this case we did not undertake synchronous bowel resection, contamination could have occurred from the colonic injury.

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